Technology Service Corporation

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HIGH NO_2 AREAS AND THEIR AIR POLLUTION CHARACTERISTICS IN THE SOUTH COAST AND SAN DIEGO AIR BASINS

TSC-PD-B656-2

June 1980

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DRAFT FINAL REPORT
Contract No. A9-053-31

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1. INTRODUCTION AND SUMMARY

This modest study is to assist in the selection of future NO_2 health study site(s) in the South Coast and San Diego Air Basins by characterizing air quality at each air monitoring site by NO_2 air pollution and air pollution from other pollutants. An ideal site at which to conduct an epidemiological study on the human health effects of NO_2 air pollution would be chosen from those areas having high air pollution from nitrogen dioxide (NO_2) and low air pollution from all other pollutants. In highly urbanized areas such as the South Coast and San Diego Air Basins, however, the air pollution is made up of NO_2 as well as many other pollutants, such as photochemical oxidants (OX), sulfur dioxide (SO_2), carbon monoxide (CO), total suspended particulates (TSP), and nitric oxide (NO).

Therefore, the current study is intended to provide, in easily understandable forms, air pollution characteristics of several high NO_2 areas so that health effects researchers can select the best available site for a future NO_2 health effect study from the two air basins, South Coast (i.e., Greater Los Angeles) and San Diego. Because a reference area with low NO_2 can easily be found from "clean" regions, no effort is made in this study to identify such an area.

The current study proceeded in the following steps: First, several candidate sites were selected from each of the two air basins by considering both mean and highest NO_2 concentrations measured at each of 37 air monitoring stations over the two air basins (Section 2). Second, ways of

visually presenting the characteristics of air pollution from the six pollutants at each candidate site were explored (Section 3). At this point in the analysis, a determination of the best site(s) for a future health effect study required a comparison between NO_2 levels and other pollutant levels at the same site and also between the level of a pollutant at a given site and those for the same pollutant at other sites. To make such multi-comparisons possible, a metroglyph with six radiating axes was used, each axis representing the pollution level of one of the six pollutants examined in this study. Third, the metroglyph analyses were applied to the candidate sites in the South Coast Air Basin (Section 4) and in the San Diego Air Basin (Section 5). After examining the shape of the metroglyphs and the summary statistics of air quality at each site, we have recommended a few high NO_2 sites for a future epidemiological study area.

1.1 SUMMARY OF CONCLUSIONS

Using ambient air quality monitoring data during the three years 1975 through 1977, the air pollution characteristics at eleven high NO_2 candidate sites in the South Coast Air Basin and six candidate sites in the San Diego Air Basin have been analyzed. The analysis was made by tabulating an air quality summary for each of the six pollutants (NO_2, NO, OX, SO_2, CO, and TSP) and by plotting air quality values of the six pollutants on a metroglyph with six radiating axes, each axis representing the air quality of a particular pollutant. Results of the analysis suggest the following:

- A metroglyph is found to be an effective means of presenting characteristics of air pollution from multiple pollutants and is probably the only means by which air pollution at several different sites can be compared in its totality.

- None of the candidate sites chosen from the South Coast and San Diego Air Basins meets simultaneously the two conditions for an ideal high NO_2 site: high NO_2 air pollution and low air pollution from all other pollutants. A site with high NO_2 air pollution tends to have high air pollution from some other pollutants as well.

1.2 RECOMMENDATIONS

The current study has produced a comprehensive air quality summary of six major pollutants and has presented, in the form of an easily understandable metroglyph, air pollution characteristics of each candidate high NO_2 site. The air pollution at each site is characterized by concentration levels of the six pollutants and by their daily and seasonal variations. These air quality summaries and metroglyphs provide researchers on air pollution health effects with convenient air quality information from which they can select the best avaialble site for their epidemiological study of NO_2 or other pollutant health effects.

In order to come up with specific recommendations on a NO_2 health effect study site, the authors conferred with the project officer on the degree of potential confounding effects on NO_2 health effects of each of the other five pollutants. We tentatively assumed that confounding effects of the traffic-related pollutants NO and CO would be less critical than those of the stationary source pollutant SO_2 and the photochemical pollutant OX. Under this tentative assumption, the following recommendations were derived:

- West Los Angeles would be the best available site in the South Coast Air Basin at which to conduct an epidemiological study of NO_2 health effects.
- Escondido would be the best available site in the San Diego Air Basin for conducting an epidemiological study of NO_2 health effects.
- From an air quality standpoint, winter is a better season for conducting a NO_2 health effect study than is summer, because it tends to bring about higher NO_2 and lower OX air pollution than does the summer season.

2. SELECTION OF CANDIDATE SITES

An ideal site for an epidemiological study of NO_2 health effects should have high air pollution from NO_2 and low air pollution from all other pollutants so that one can isolate NO_2 effects on human health from any confounding effects of other pollutants. In the South Coast and San Diego Air Basins, however, areas with high NO_2 air pollution tend to have high air pollution from some other pollutants such as CO, TSP, and OX. Therefore, in this section, we first select several candidate sites by considering NO_2 concentration levels alone. In sections that follow, the air pollution from NO_2 and other pollutants at those candidate sites are characterized by preparing a summary table of six major pollutants' (NO_2, NO, OX, SO_2, CO and TSP) levels and by constructing a metroglyph with six radiating axes, each of which represents a pollution level of one of the six pollutants.

Ambient air quality monitoring data [1] during three years, 1975 through 1977, were used for the current analysis to select candidate sites for the South Coast and San Diego Air Basins and to characterize the air pollution at those candidate sites. Table 1 presents the annual statistics of several key air quality parameters for NO_2 at each of six air monitoring stations in the San Diego Air Basin [2,5]. Table 2 presents the same statistics for 31 air monitoring stations within and in the periphery of the South Coast Air Basin [2,3,4]. The air quality parameters used are the annual highest 1-hr concentration, the annual

TABLE 1. ANNUAL STATISTICS OF AMBIENT NO_2 CONCENTRATIONS AT VARIOUS AIR MONITORING SITES IN THE SAN DIEGO AIR BASIN IN 1975 (ALL VALUES IN PPHM)

SITE	No. of Obs.	Highest 1-Hr Concentrations	Mean of 1-Hr Concentrations	Mean of Daily Max. 1-Hr Concentrations	Hourly Concentrations at 95%	90%	75%	50%	25%
El Cajon *1	5959	32	3.9	7.3	9	7	5	3	2
Oceanside *3	7324	31	2.3	5.1	6	5	3	2	1
San Diego-Dwntwn *3	7978	46	4.2	7.7	12	9	6	3	2
Chula Vista *2	8225	24	3.4	6.6	8	7	4	3	2
Escondido *2	7974	36	3.8	7.0	8	7	5	3	2
Kearny Mesa *2	8569	37	3.1	6.5	8	6	4	2	1
Avg. of all Stations		34.3	3.5	6.7	8.5	6.8	4.5	2.7	1.7

*1 Colorimetric Method Used

*2 Chemiluminescent Method Used

*3 Both Methods Used

TABLE 2. ANNUAL STATISTICS OF AMBIENT NO_2 CONCENTRATIONS AT VARIOUS AIR MONITORING SITES IN THE SOUTH COAST AND SOUTHEAST DESERT AIR BASINS IN 1975 (ALL VALUES IN PPHM)

Air Monitoring Site	No. of Obs.	Highest 1-Hr Concentrations	Mean of 1-Hr Concentrations	Mean of Daily Max. 1-Hr Concentrations	Hourly Concentrations at 95%	90%	75%	50%	25%
Anaheim	7563	50	5.4	9.2	13	10	7	4	3
Azusa	8047	37	6.0	10.6	13	11	8	5	3
Burbank	8196	48	7.4	12.7	17	14	9	6	4
Chino-Riverside Ave.*[1]	6564	9	1.8	3.4	4	3	3	2	1
Costa Mesa-Harbor	7123	35	3.0	6.5	10	7	4	2	1
Fontana-Foothill*[1]	7568	26	4.1	7.8	10	8	6	4	2
Goleta*[1]	6316	15	2.0	4.3	5	4	3	2	1
La Habra	7752	46	6.4	10.9	15	12	8	5	4
Lennox	8202	40	5.6	10.1	13	10	7	5	3
Long Beach	7834	45	6.2	11.0	15	12	8	5	3
Los Angeles-Dwntwn	8012	56	6.7	12.9	16	12	8	5	4
Lynwood	8073	32	5.2	9.2	13	10	6	4	3
Newhall	8251	23	3.2	5.6	7	6	4	3	2

Underlined sites were included in this study.

*[1] Chemiluminescent Method was used.

TABLE 2. (cont'd)

Air Monitoring Site	No. of Obs.	Highest 1-Hr Conc.	Mean of 1-Hr Concentrations	Mean of Daily Max. 1-Hr Concentrations	Hourly Concentrations at 95%	90%	75%	50%	25%
Pasadena-Walnut	8211	49	8.2	14.1	18	14	10	7	5
Point Magu*1	6807	8	0.7	1.7	2	2	1	1	0
Pomona	8284	41	7.2	11.9	15	12	9	6	5
Reseda	8378	33	6.4	11.8	15	12	8	5	3
Riverside-Magnolia	7733	30	5.6	9.6	12	10	7	5	3
Riverside-Rubidoux	8191	21	3.0	6.1	8	6	4	2	1
San Bernardino	8022	25	4.0	8.0	10	8	6	3	2
Temple City	7479	42	7.7	12.7	16	13	9	7	5
Upland-ARB	7797	26	4.8	9.1	10	9	6	4	3
Upland-Civic Center*1	6013	9	1.2	2.5	3	3	2	1	0
West Los Angeles	8067	60	6.8	13.4	16	12	8	6	4
Whittier	8313	62	7.2	12.5	16	13	9	6	4
Camarillo-Elm Dr.	7975	18	2.2	4.3	5	4	3	2	1

Underlined sites were included in this study.

*1 Chemiluminescent Method was used.

TABLE 2. (concluded)

Air Monitoring Site	No. of Obs.	Highest 1-Hr Conc.	Mean of 1-Hr Concentrations	Mean of Daily Max. 1-Hr Concentrations	Hourly Concentrations at 95%	90%	75%	50%	25%
Santa Barbara-State St.	7751	21	3.2	5.3	7	6	4	3	2
Barstow	8288	23	2.0	4.8	7	5	3	1	0
Indio-Oasis St.	7941	9	1.7	3.5	4	3	3	1	1
Lancaster	8348	12	1.8	3.7	4	3	2	1	1
Victorville	8062	30	2.9	7.7	9	7	4	2	1
Avg. of Study Sites		48.6	6.7	11.8	15.3	12.1	8.3	5.5	3.8
Avg. of all Stations		31.6	4.5	8.5	10.6	8.4	5.8	3.7	2.4

Underlined sites were included in this study.

*[1] Chemiluminescent Method was used.

mean of all hours, the annual mean of daily maximum 1-hr concentrations, and the hourly concentrations at 95%, 90%, 75%, 50%, and 25%.

Because the San Diego Air Basin has only six NO_2 air monitoring stations, El Cajon, Oceanside, San Diego-Downtown, Chula Vista, Escondido and Kearny Mesa, all six were used as candidate sites. For the South Coast Air Basin, the eleven underlined sites in Table 2 were used as candidate sites. They are: Anaheim, Azusa, Burbank, La Habra, Lennox, Long Beach, Los Angeles-Downtown, Pasadena-Walnut, Temple City, West Los Angeles, and Whittier. Figure 1 shows the location of the six candidate sites in the San Diego Air Basin; Figure 2 depicts the location of the eleven candidate sites in the South Coast Air Basin.

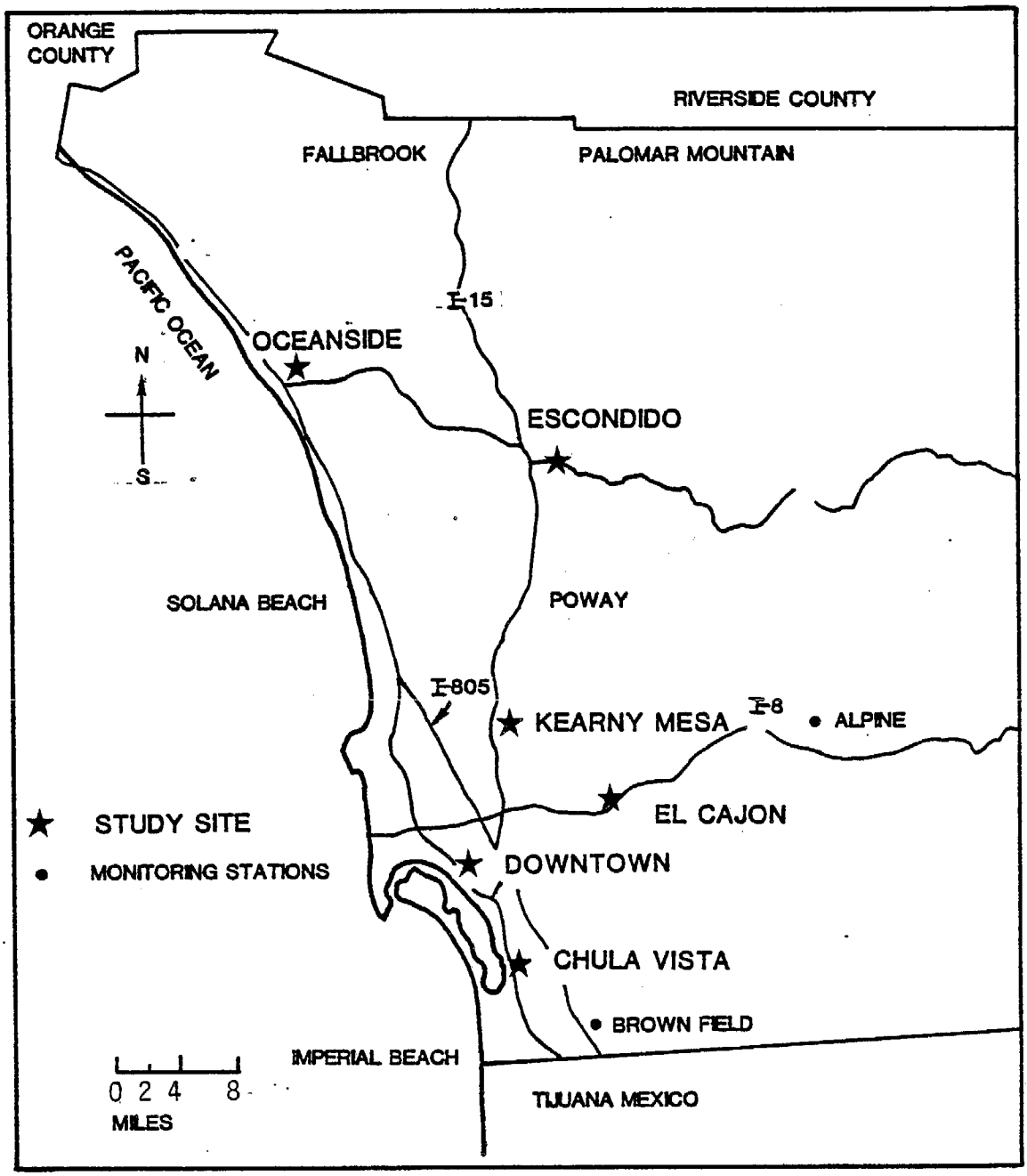


Figure 1. Location of Six Candidate High NO_2 Sites in the San Diego Air Basin

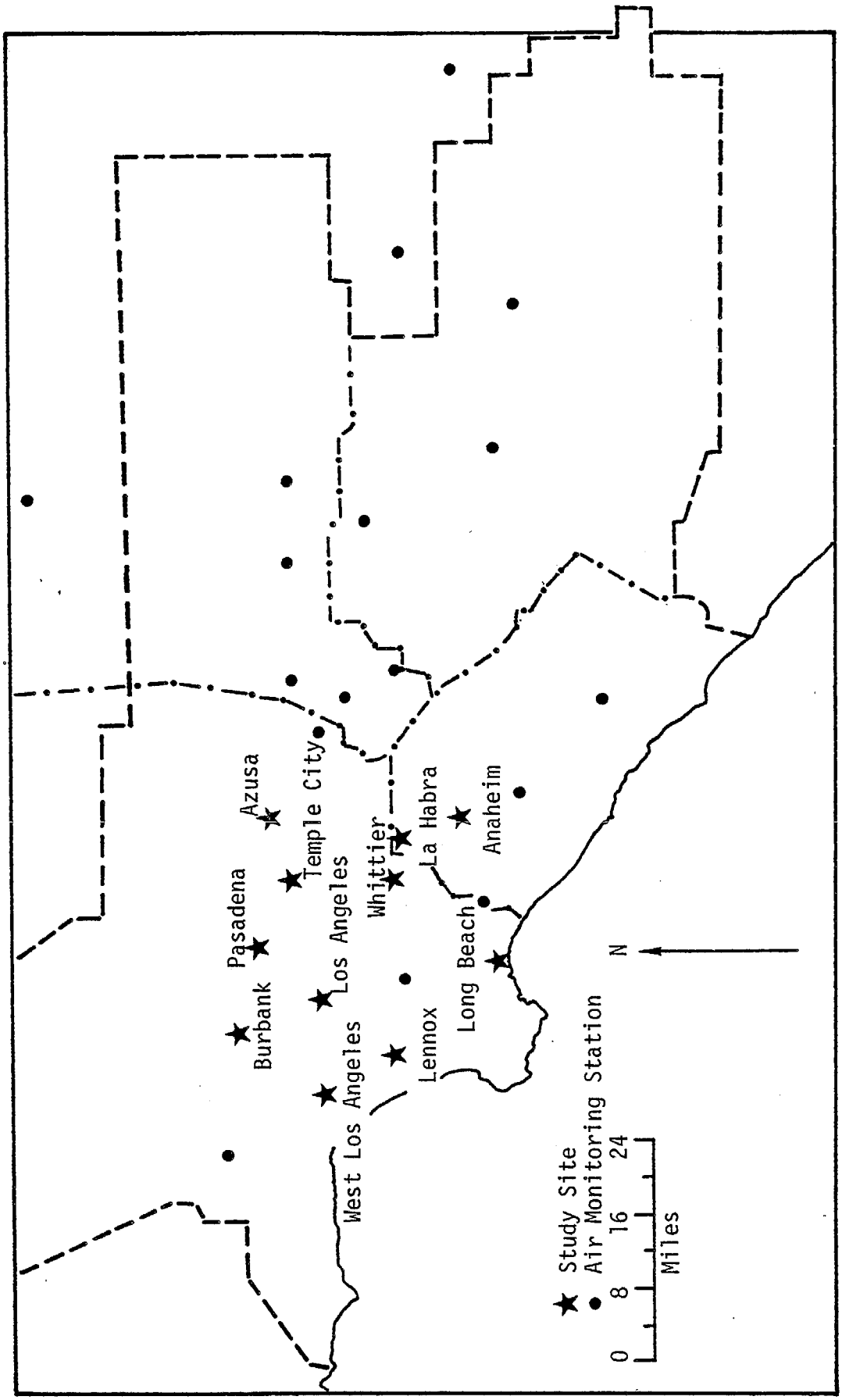


Figure 2. Location of Eleven Candidate High NO_2 Sites in the South Coast Air Basin

3. METROGLYPH PRESENTATION OF AIR POLLUTION CHARACTERISTICS

What we call "air pollution" has many faces, and characterizing it is not as easy as one might think. For example, high air pollution might mean a high pollution level in NO_2, SO_2, short-term peak, or long-term average concentrations. Therefore, a determination of high NO_2 areas for an epidemiological study needs to consider, at a minimum, the following:

i) Both long-term average and short-term peak NO_2 concentrations at each candidate site.

ii) NO_2 levels at a given site relative to those at other candidate sites.

iii) NO_2 levels relative to other pollutant levels at the same site.

iv) Pollution levels of non-NO_2 pollutants at a given site relative to those at other candidate sites.

To make the above considerations possible, we computed air quality parameters similar to those in Tables 1 and 2 for each pollutant, each year, and for each candidate site by using hourly air quality monitoring data during three years, 1975 through 1977. The results were then tabulated separately for each pollutant and for each of the two air basins. Table 3 is a sample tabulation for NO_2 for the South Coast Air Basin. The air quality parameters used in the table are the annual mean of all hourly concentrations, the annual mean of daily maximum 1-hr concentrations, the first- and third-quarter means of all hourly concentrations, and the

TABLE 3. SUMMARY STATISTICS OF NO_2 AIR QUALITY FOR EACH OF THE ELEVEN CANDIDATE SITES IN THE SOUTH COAST AIR BASIN

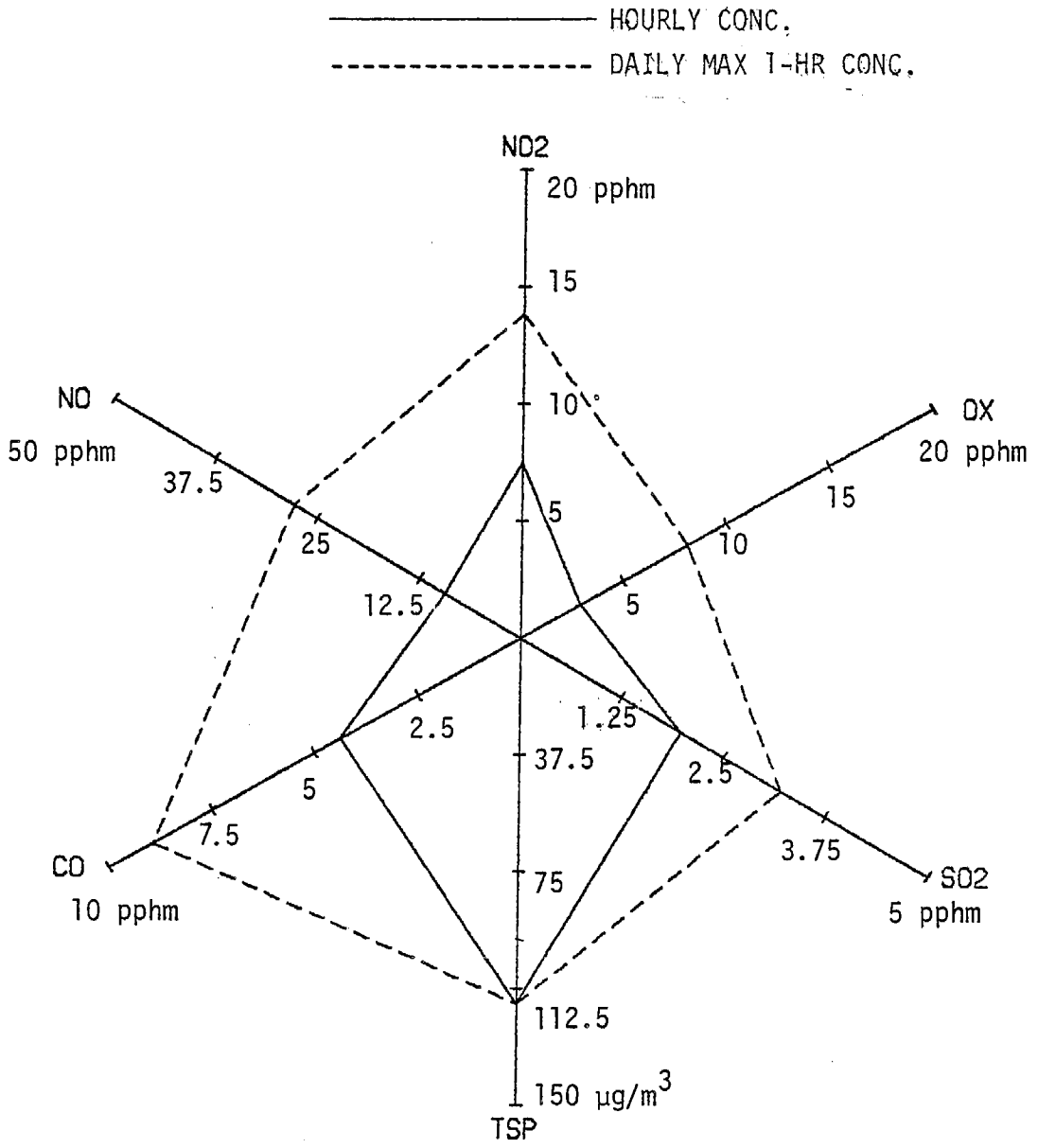
Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
ANAHEIM	6.42	4.47	5.54	9.30	50	46	29
LA HABRA	6.03	5.14	5.76	9.65	46	28	39
LOS ANGELES-DWNTWN	8.38	6.17	7.53	13.85	56	53	60
AZUSA	5.30	6.05	5.96	10.83	37	31	40
BURBANK	7.36	6.59	7.37	12.55	48	38	46
WEST LOS ANGELES	8.48	5.66	7.41	14.02	60	46	56
LONG BEACH	7.57	5.47	6.91	12.11	45	43	43
LENNOX	7.52	5.10	6.57	11.37	40	39	43
WHITTIER	8.06	6.08	7.25	12.14	62	52	69
PASADENA - WALNUT	8.0[a]	8.6[a]	8.2[a]	14.1[a]	49	38	48
TEMPLE CITY	7.22	6.90	7.50	12.27	42	37	46

[a]Values are for 1975 only.

annual highest 1-hr concentrations in 1975, 1976, and 1977. The annual and quarterly means are averaged over the three years. Complete summary statistics for all six pollutants are given in Appendix A for the South Coast Air Basin and in Appendix B for the San Diego Air Basin.

Although the summary statistics in Appendices A and B provide a cross-sectional pollution picture over the candidate sites for a given pollutant, it is rather difficult to obtain from these statistics an overall pollution picture for all six pollutants. A metroglyph with six radiating axes, each of which represents the pollution level of a particular pollutant, is used to present an overall pollution picture, as shown in Figure 3. This particular metroglyph depicts the annual means of hourly and daily max 1-hr concentrations for all six pollutants (NO_2, NO, OX, SO_2, CO and TSP) at Los Angeles-Downtown. The concentration scale for each pollutant was determined by considering the basin maximum value for the pollutant and the air quality parameter(s) which are plotted in the metroglyph.

The concentration units used in the metroglyph shown in Figure 3 and those shown in the two sections that follow are: parts per hundred million (pphm) for NO_2, NO, OX and SO_2; parts per million (ppm) for CO; and micrograms per cubic meter ($\mu g/m^3$) for TSP. These units were chosen simply because the original data are recorded in those units and also because ambient concentration levels are most conveniently expressed in those units.



LOS ANGELES-DWNTWN

SCALES

OX	20.0	pphm	CO	10.0	ppm
NO2	20.0	pphm	TSP	150.0	$\mu g/m^3$
NO	50.0	pphm	SO2	5.0	pphm

Figure 3. Air Pollution Characteristics at Downtown Los Angeles: 3-Year Average of Hourly Concentrations and Daily Max 1-Hr Concentration (24-hr Concentration for TSP).

4. HIGH NO_2 AREAS IN THE SOUTH COAST AIR BASIN

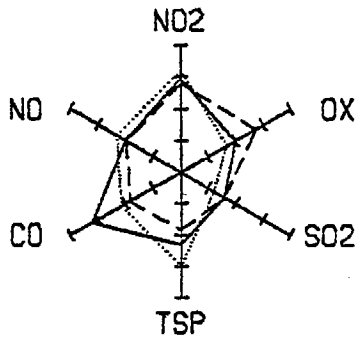
This section examines the air pollution characteristics at each of the eleven candidate high NO_2 sites selected from the South Coast Air Basin. The air pollution characteristics of the candidate sites are pictorially presented by the three sets of metroglyphs shown in Figures 4, 5, and 6.

Figure 4 shows the annual highest 1-hr concentration of each of the six pollutants at each candidate site. The yearly values are separately plotted for 1975, 1976 and 1977. Although the parameter values vary from year to year, two sites, Los Angeles and West Los Angeles, exhibit very high NO_2 concentrations but not such high concentrations of OX and SO_2 as those at other sites. The concentrations of NO and CO at the two sites are also high, however, with Lennox having the highest. TSP data are not very complete at the eleven sites. (The missing data is designated by an asterisk *.) The TSP level at Los Angeles is one of the highest among the eleven sites, while the TSP level at West Los Angeles appears to be one of the lowest. Should the confounding effects of NO, CO, and NO_2 on human health be less critical than those of OX, SO_2, and NO_2, then West Los Angeles would be a reasonable site for conducting an epidemiological study of the short-term NO_2 health effects.

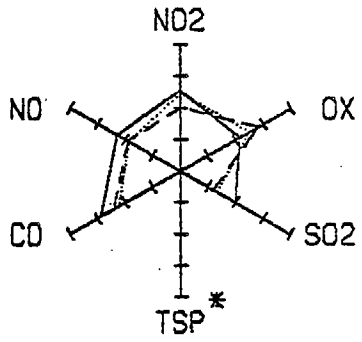
Figure 5 depicts the annual mean pollution levels of the six pollutants at each of the eleven candidate sites. In the figure, annual means of hourly concentrations and those of daily max 1-hr concentrations are averaged over the three years, 1975 through 1977. Three sites, Los Angeles, West Los Angeles, and Pasadena, have approximately the same

ANNUAL HIGHEST 1-HR CONCENTRATIONS (24-hr Concentration for TSP)

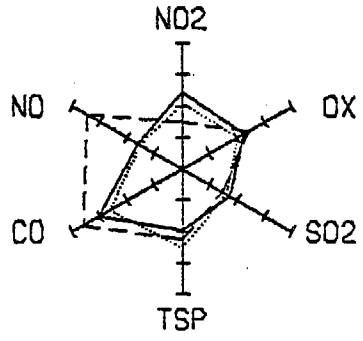
———————— 1975
- - - - - - - - - - - - 1976
———————— 1977
* MISSING DATA



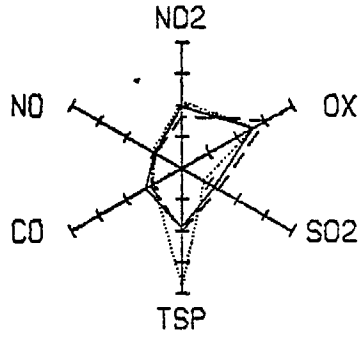
LOS ANGELES-DWNTWN



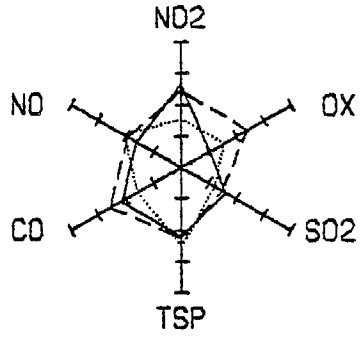
BURBANK



LA HABRA



AZUSA



ANAHEIM

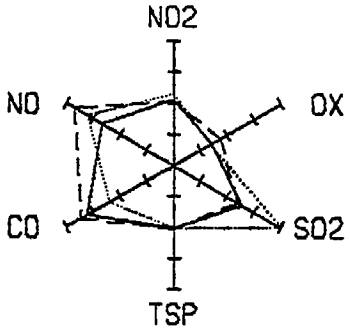
SCALES

OX	50.0 pphm	CO	50.0 ppm
NO2	75.0 pphm	TSP	450.0 $\mu g/m^3$
NO	200.0 pphm	SO2	30.0 pphm

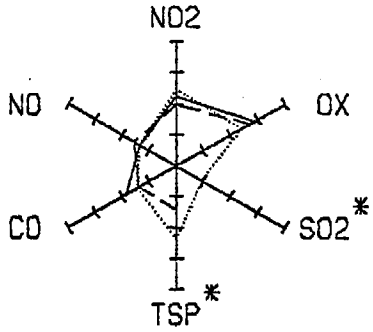
Figure 4a. Annual Highest 1-Hr Concentrations in 1975, 1976, and 1977 in the South Coast Air Basin

ANNUAL HIGHEST 1-HR CONCENTRATIONS (24-hr Concentration for TSP)

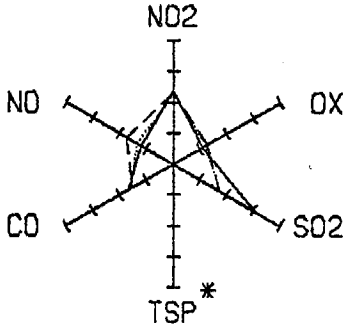
——————— 1975
- - - - - - - - - - - 1976
——————— 1977
* MISSING DATA



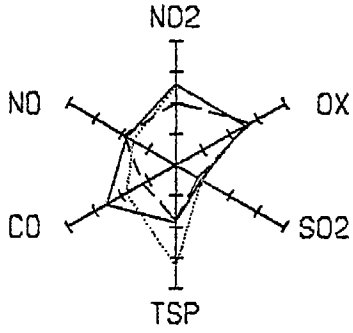
LENNOX



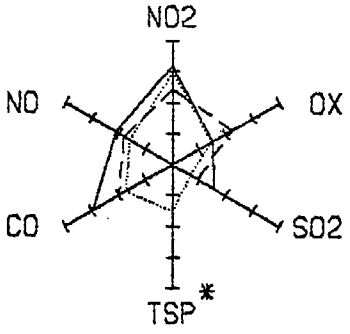
TEMPLE CITY



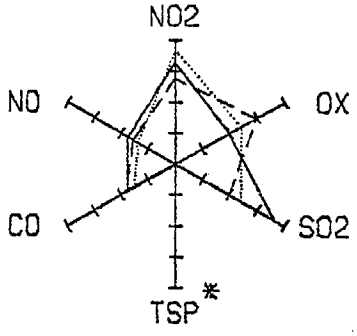
LONG BEACH



PASADENA - WALNUT



WEST LOS ANGELES



WHITTIER

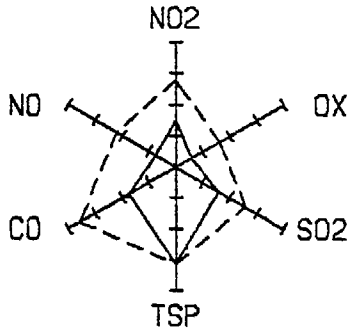
SCALES

OX	50.0 pphm	CO	50.0 ppm
NO2	75.0 pphm	TSP	450.0 $\mu g/m^3$
NO	200.0 pphm	SO2	30.0 pphm

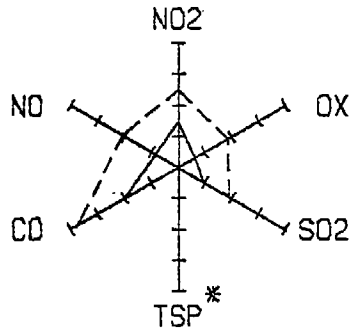
Figure 4b. Annual Highest 1-Hr Concentrations in 1975, 1976, and 1977 in the South Coast Air Basin

3-YEAR AVG. OF HOURLY CONC. AND DAILY MAX 1-HR CONC. (24-hr Conc. for TSP)

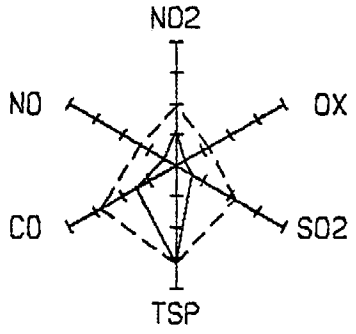
———————— HOURLY CONC.
– – – – – – – – – – – – DAILY MAX 1-HR CONC.
* MISSING DATA



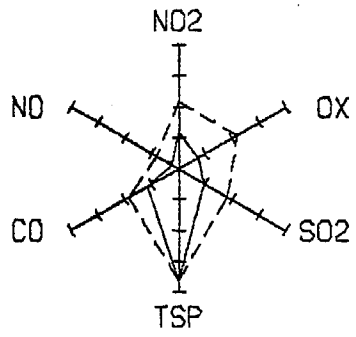
LOS ANGELES-DWNTWN



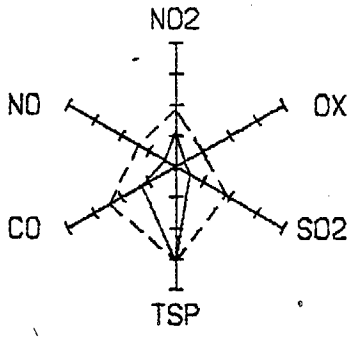
BURBANK



LA HABRA



AZUSA



ANAHEIM

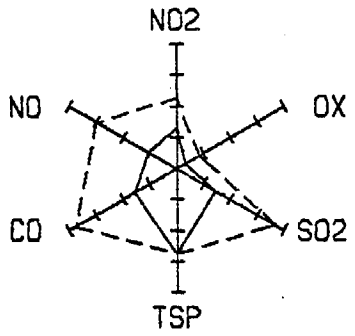
SCALES

OX	20.0 pphm	CO	10.0 ppm
NO2	20.0 pphm	TSP	150.0 $\mu g/m^3$
NO	50.0 pphm	SO2	5.0 pphm

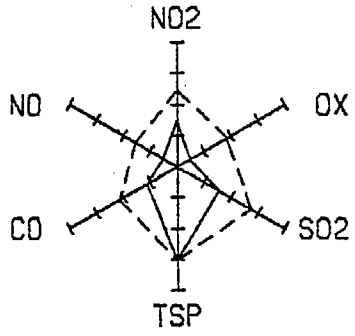
Figure 5a. Three-Year Averages of Hourly Concentrations and Daily Max 1-Hr Concentrations in the South Coast Air Basin

3-YEAR AVG. OF HOURLY CONC. AND DAILY MAX 1-HR CONC. (24-hr Conc. for TSP)

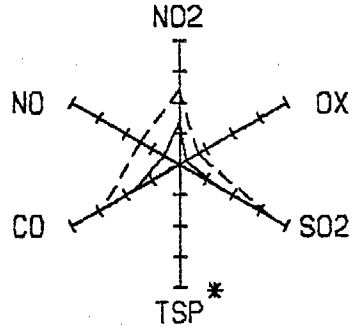
———————— HOURLY CONC.
– – – – – – – – – – – – DAILY MAX 1-HR CONC.
* MISSING DATA



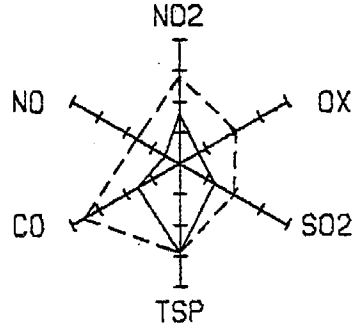
LENNOX



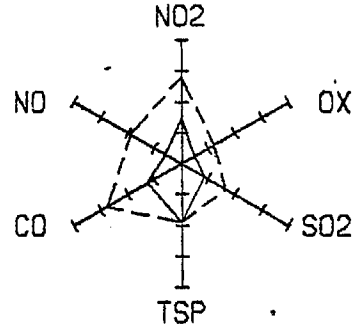
TEMPLE CITY



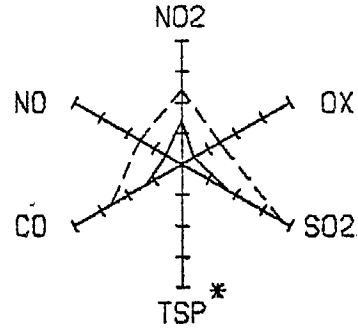
LONG BEACH



PASADENA - WALNUT



WEST LOS ANGELES



WHITTIER

SCALES

OX	20.0	pphm	CO	10.0	ppm
NO2	20.0	pphm	TSP	150.0	$\mu g/m^3$
NO	50.0	pphm	SO2	5.0	pphm

Figure 5b. Three-Year Averages of Hourly Concentrations and Daily Max 1-Hr Concentrations in the South Coast Air Basin

high NO_2 level in both the mean hourly and mean daily max 1-hr concentrations. Among the three sites, the metroglyph of Los Angeles is the largest and most circular, indicating that concentrations of the other pollutants are also high at that site. The metroglyph of West Los Angeles is the smallest, while that of Pasadena is in between. Therefore, West Los Angeles appears to be the best site for studying long-term NO_2 health effects.

Figure 6 plots the 3-year averages of hourly concentrations in the first quarter (January, February and March) and the third quarter (July, August, and September). The same three sites, Los Angeles, West Los Angeles, and Pasadena, exhibit high NO_2 levels in both quarters. However, another two sites, Burbank and Whittier, also exhibit high NO_2 levels that either almost equal or exceed the three sites' levels, particularly in the third quarter. Among the above five sites, West Los Angeles has the smallest metroglyph, indicating that concentrations of the other pollutants there are lower than those at the other sites.

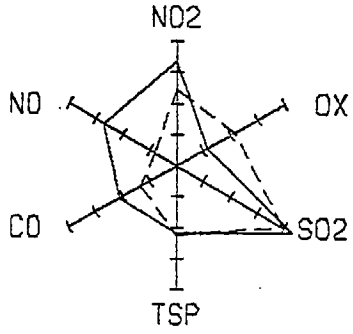
A comparison of metroglyphs for the first quarter and those for the third quarter indicates that the first quarter tends to have higher NO_2 levels. These higher levels tend to accompany higher concentrations in NO and CO but do not accompany any higher concentrations in OX. Therefore, if the confounding health effects from NO, CO, and NO_2 are less critical than those from OX and NO_2, the first quarter or winter season would be a better time for conducting a NO_2 health effect study.

3-YEAR AVG. OF ALL HOURLY CONC. (DAILY MAX 1-HR FOR OX and 24-hr for TSP)

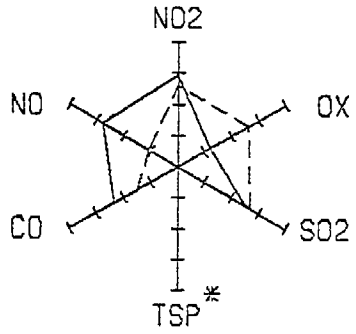
——————— FIRST QUARTER

– – – – – – – – – – – – THIRD QUARTER

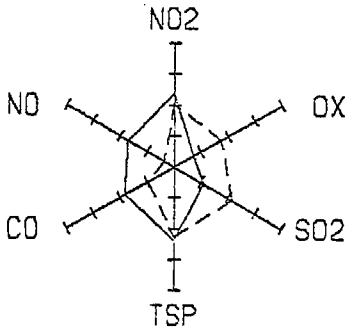
* MISSING DATA



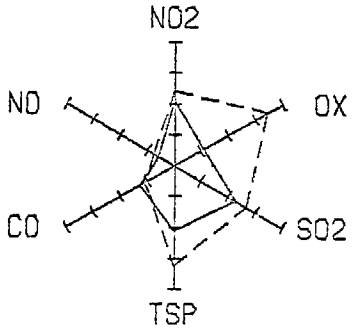
LOS ANGELES-DWNTWN



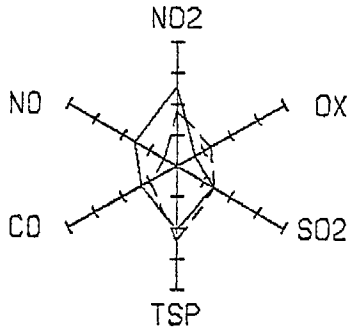
BURBANK



LA HABRA



AZUSA



ANAHEIM

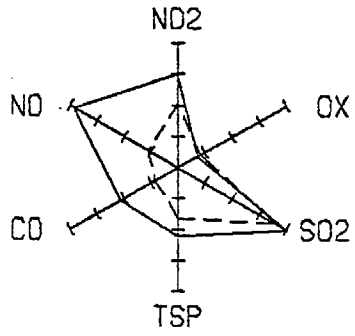
SCALES

OX	20.0	pphm	CO	10.0	ppm
NO2	10.0	pphm	TSP	200.0	$\mu g/m^3$
NO	20.0	pphm	SO2	2.0	pphm

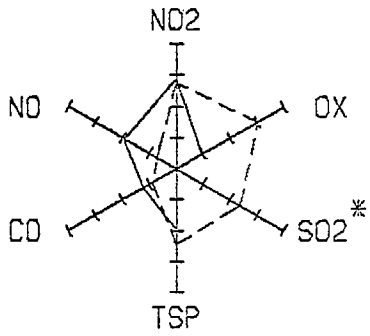
Figure 6a. Three-Year Average of All Hourly (Daily Max 1-Hr for OX) Concentrations in the South Coast Air Basin for the First and Third Quarters

3-YEAR AVG. OF ALL HOURLY CONC. (DAILY MAX 1-HR FOR OX and 24-hr for TSP)

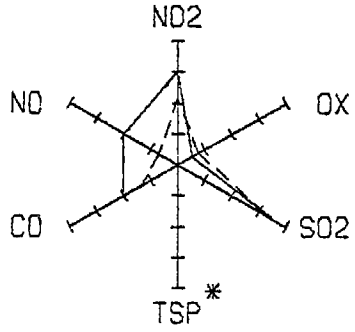
——————————— FIRST QUARTER
– – – – – – – – – – – – THIRD QUARTER
* MISSING DATA



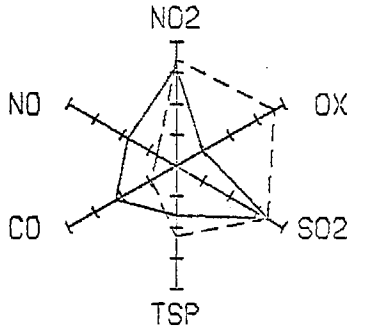
LENNOX



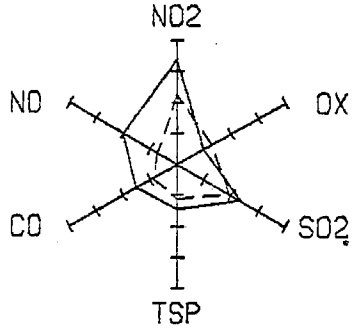
TEMPLE CITY



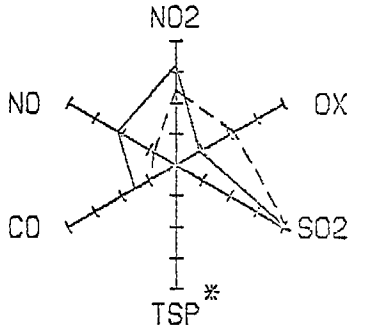
LONG BEACH



PASADENA - WALNUT



WEST LOS ANGELES



WHITTIER

SCALES

OX	20.0	pphm	CO	10.0	ppm
NO2	10.0	pphm	TSP	200.0	$\mu g/m^3$
NO	20.0	pphm	SO2	2.0	pphm

Figure 6b. Three-Year Average of All Hourly (Daily Max 1-Hr for OX) Concentrations in the South Coast Air Basin for the First and Third Quarters

5. HIGH NO_2 AREAS IN THE SAN DIEGO AIR BASIN

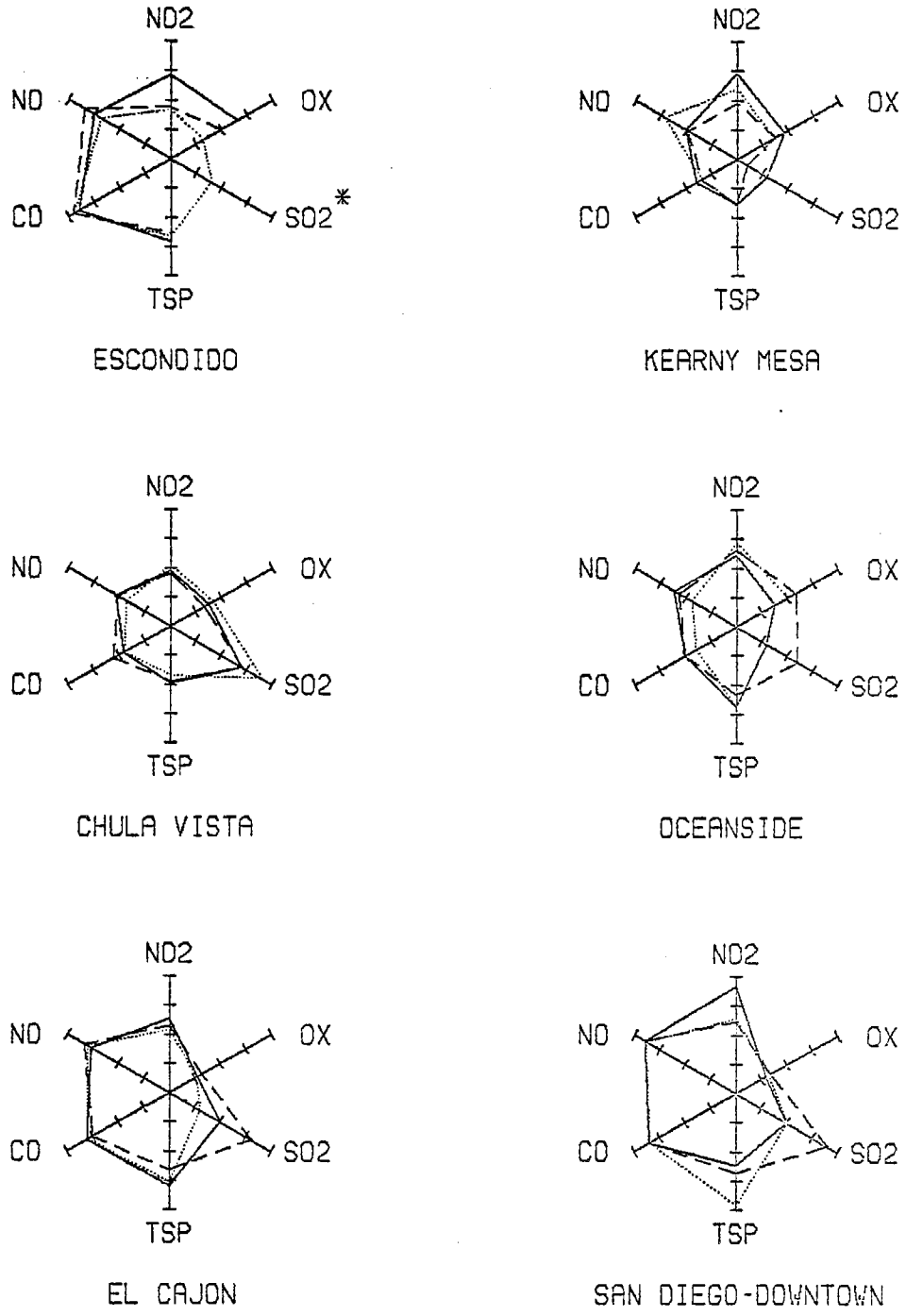
This section examines the air pollution characteristics at each of the six candidate high NO_2 sites selected from the San Diego Air Basin. The air quality characteristics of the candidate sites are pictorially presented by three sets of metroglyphs, Figures 7, 8, and 9. Plotted on these metroglyphs are air quality values of the six pollutants (NO_2, NO, OX, SO_2, CO and TSP) for the following parameters: the annual highest 1-hr concentration (Figure 7), the 3-year averages of hourly and daily max 1-hr concentrations (Figure 8), and the 3-year averages of first-quarter and third-quarter mean concentrations (Figure 9).

Figure 7 shows the characteristics of short-term peak air pollution at the six candidate sites by plotting on a metroglyph the annual highest 1-hr concentrations for each of the six pollutants in 1975, 1976, and 1977. San Diego-Downtown has the highest NO_2 level, followed by El Cajon and Oceanside. All three sites, however, have high peak concentrations in other pollutants as well. Therefore, there appears to be no ideal site in the San Diego Air Basin for conducting an epidemiological study on acute NO_2 health effects.

Figure 8 pictorially presents the characteristics of long-term average air pollution at the candidate sites. Plotted on the metroglyphs are the 3-year average of hourly and daily max 1-hr concentrations in each of the six pollutants. While San Diego and El Cajon have high SO_2 levels, the rest of the sites have very low SO_2 levels. Among the sites with low SO_2, Escondido has the highest NO_2 level in both the 3-year averages of

ANNUAL HIGHEST 1-HR CONCENTRATION (24-hr Concentration for TSP)

1975
1976
1977
* MISSING DATA



SCALES

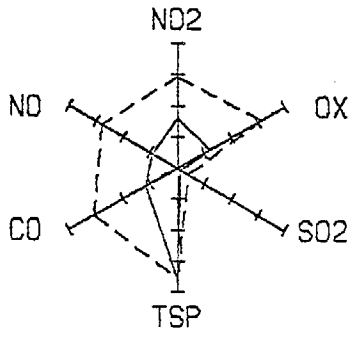
OX	50.0	pphm	CO	20.0	ppm
NO2	50.0	pphm	TSP	250.0	$\mu g/m^2$
NO	100.0	pphm	SO2	10.0	pphm

Figure 7. Annual Highest 1-Hr Concentrations in 1975, 1976, and 1977 in the San Diego Air Basin

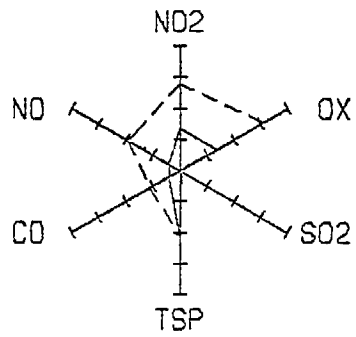
3-YEAR AVG. OF HOURLY CONC. AND DAILY MAX 1-HR CONC. (24-hr Conc. for TSP)

———————— HOURLY CONC.

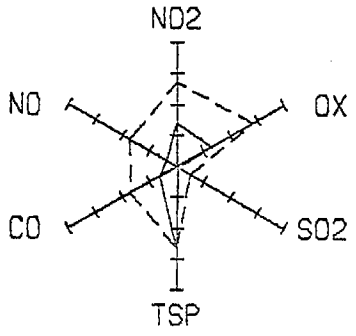
– – – – – – – – – – – – DAILY MAX 1-HR CONC.



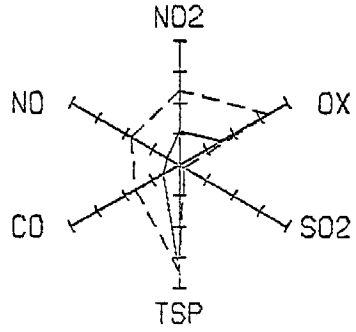
ESCONDIDO



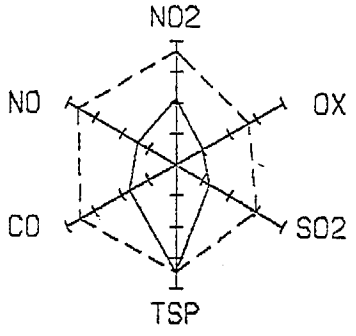
KEARNY MESA



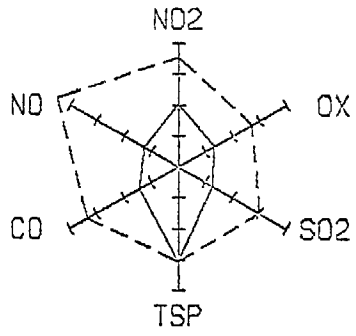
CHULA VISTA



OCEANSIDE



EL CAJON



SAN DIEGO-DOWNTOWN

SCALES

OX	8.Ø	pphm	CO	5.Ø	ppm
NO2	1Ø.Ø	pphm	TSP	1ØØ.Ø	$\mu g/m^3$
NO	2Ø.Ø	pphm	SO2	1.6	pphm

Figure 8. Three-Year Averages of Hourly Concentrations and Daily Max 1-Hr Concentrations in the San Diego Air Basin

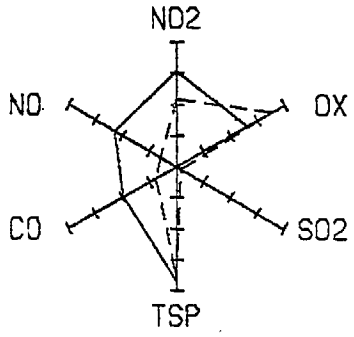
hourly and daily max 1-hr concentrations. The concentrations of OX, NO, CO and TSP at Escondido are also fairly high.

Figure 9 provides the air pollution characteristics in the first quarter (January, February and March) and the third quarter (July, August and September). Concentrations of NO_2, NO, CO, and TSP tend to be higher in the first quarter than in the third quarter, while OX concentrations are lower in the first quarter at all sites. In particular, the first-quarter OX level at Escondido is considerably lower than that of the third quarter. The first-quarter pollution levels at Escondido are high in NO_2 and TSP, moderate in NO and CO, and low in SO_2. Therefore, if the confounding effects of TSP, CO, NO, and NO_2 are not as critical as those of OX, SO_2, and NO_2, the best season and best site for a NO_2 health effect study in the San Diego Air Basin would be at Escondido in the winter season. Note, however, that ambient NO_2 levels at Escondido and other candidate sites in the San Diego Air Basin are considerably lower than those at West Los Angeles and other candidate sites in the South Coast Air Basin.

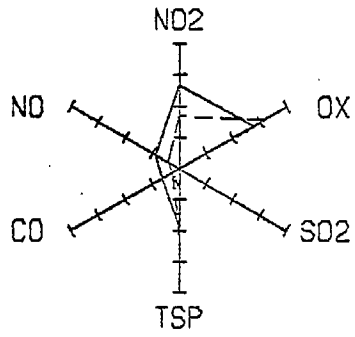
3-YEAR AVG. OF ALL HOURLY CONC. (DAILY MAX 1-HR FOR OX and 24-hr for TSP)

——————— FIRST QUARTER

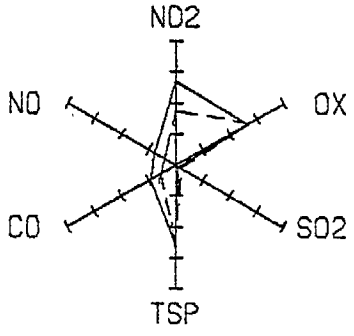
– – – – – – – – – – – THIRD QUARTER



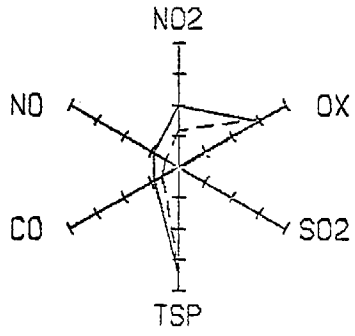
ESCONDIDO



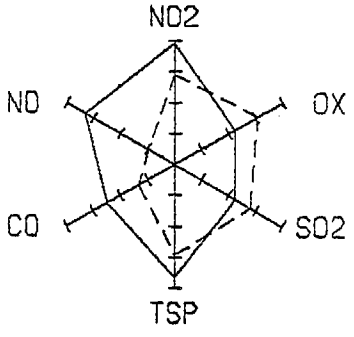
KEARNY MESA



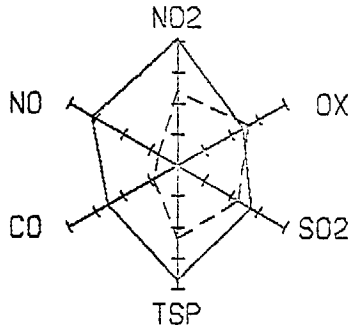
CHULA VISTA



OCEANSIDE



EL CAJON



SAN DIEGO-DOWNTOWN

SCALES

OX	8.0	pphm	CO	4.0 ppm
NO2	6.0	pphm	TSP	100.0 $\mu g/m^3$
NO	12.0	pphm	SO2	0.8 pphm

Figure 9. Three-Year Average of All Hourly (Daily Max 1-Hr for OX) Concentrations in the San Diego Air Basin for the First and Third Quarters

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1. California ARB, "Air Quality Data Tapes - Gaseous and Particulate Pollutants," obtained from Technical Services Division, California Air Resources Board, Sacramento, CA, 1979.

2. California ARB, "Three-Year Summary of California Air Quality Data 1973-1975," California Air Resources Board, Technical Services Division, Sacramento, CA, January 1977.

3. California ARB, "California Air Quality Data - Annual Summary," Volumes 7, 8 and 9 for 1975, 1976 and 1977, California Air Resources Board, Technical Services Division, Sacramento, CA.

4. South Coast AQMD, "Air Quality and Meteorology - Monthly Summary," Volumes 20, 21 and 22 for 1975, 1976 and 1977, South Coast Air Quality Management District (Formerly Southern California Air Pollution Control District), El Monte, CA.

5. San Diego APCD, "Air Quality in San Diego County - Annual Air Monitoring Report 1977," San Diego County Air Pollution Control District, San Diego, CA.

Appendix A

AIR QUALITY SUMMARY FOR ELEVEN CANDIDATE SITES IN THE SOUTH COAST AIR BASIN

TABLE A1. SOUTH COAST AIR BASIN NITROGEN DIOXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
ANAHEIM	6.42	4.47	5.54	9.30	50	46	29
LA HABRA	6.03	5.14	5.76	9.65	46	28	39
LOS ANGELES-DWNTWN	8.38	6.17	7.53	13.85	56	53	60
AZUSA	5.30	6.05	5.96	10.83	37	31	40
BURBANK	7.36	6.59	7.37	12.55	48	38	46
WEST LOS ANGELES	8.48	5.66	7.41	14.02	60	46	56
LONG BEACH	7.57	5.47	6.91	12.11	45	43	43
LENNOX	7.52	5.10	6.57	11.37	40	39	43
WHITTIER	8.06	6.08	7.25	12.14	62	52	69
PASADENA - WALNUT	8.0[a]	8.6[a]	8.2[a]	14.1[a]	49	38	48
TEMPLE CITY	7.22	6.90	7.50	12.27	42	37	46

[a]Values are for 1975 only.

TABLE A2. SOUTH COAST AIR BASIN NITRIC OXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
ANAHEIM	7.67	2.14	5.29	17.35	81	97	103
LA HABRA	8.46	1.89	5.63	16.50	80	172	76
LOS ANGELES-DWNTWN	13.47	4.13	9.41	27.88	100	97	116
AZUSA	2.91	3.79	3.20	10.17	48	47	54
BURBANK	13.92	5.35	10.73	26.00	115	95	94
WEST LOS ANGELES	9.94	3.61	7.37	23.64	105	90	80
LONG BEACH	9.92	3.48	7.15	17.88	59	86	67
LENNOX	19.15	5.50	13.01	37.25	133	185	161
WHITTIER	10.78	4.12	7.46	19.42	87	77	69
PASADENA - WALNUT	8.9[a]	3.5[a]	6.6[a]	19.7[a]	90	95	79
TEMPLE CITY	9.66	3.47	6.68	19.55	66	78	68

[a]Values are for 1975 only.

TABLE A3. SOUTH COAST AIR BASIN TOTAL OXIDANT

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Daily Max. 1-Hr Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
ANAHEIM	3.30	6.24	1.58	4.85	13	30	19
LA HABRA	3.63	8.72	1.71	6.13	28	30	25
LOS ANGELES-DWNTWN	5.75	10.67	2.93	8.15	25	34	21
AZUSA	5.52	17.24	3.66	10.89	32	38	32
BURBANK	6.04	12.98	3.18	9.30	27	35	31
WEST LOS ANGELES	4.94	6.40	2.37	6.09	19	28	18
LONG BEACH	2.72	3.89	1.33	3.42	14	16	15
LENNOX	3.67	4.27	1.67	4.20	18	22	17
WHITTIER	4.52	10.78	2.28	7.00	25	37	30
PASADENA - WALNUT	5.0[a]	18.1[a]	3.6[a]	10.5[a]	32	34	32
TEMPLE CITY	4.88	14.98	2.37	9.26	36	34	30

[a]Values are for 1975 only.

TABLE A4. SOUTH COAST AIR BASIN SULFUR DIOXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
ANAHEIM	0.68	0.70	0.65	2.26	12	11	9
LA HABRA	0.55	1.07	0.73	2.72	13	11	12
LOS ANGELES-DWNTWN	2.13	1.97	1.97	3.21	12	12	9
AZUSA	1.13	1.33	1.19	2.28	9	10	6
BURBANK	1.23	1.34	1.21	2.35	15	9	10
WEST LOS ANGELES	1.16	0.96	1.06	2.04	12	7	5
LONG BEACH	1.71	1.63	1.68	4.22	23	13	13
LENNOX	2.00	1.80	1.82	4.58	19	18	30
WHITTIER	2.10	2.08	2.03	4.55	27	15	18
PASADENA - WALNUT	1.7[a]	1.7[a]	1.6[a]	2.5[a]	7	6	7
TEMPLE CITY	****	1.19[b]	1.93[b]	3.41[b]	**	**	7

[a]Values are for 1975 only.

[b]Values are for 1977 only.

TABLE A5. SOUTH COAST AIR BASIN CARBON MONOXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
ANAHEIM	3.22	2.41	3.17	6.08	27	32	20
LA HABRA	4.49	2.41	3.70	7.03	38	45	33
LOS ANGELES-DWNTWN	5.25	3.32	4.38	8.95	40	23	27
AZUSA	3.17	2.73	2.88	4.64	16	14	13
BURBANK	5.86	3.73	5.02	9.32	36	30	28
WEST LOS ANGELES	3.76	2.18	3.11	6.95	37	25	22
LONG BEACH	5.07	3.38	4.26	7.22	21	19	20
LENNOX	5.32	2.08	3.86	9.37	40	43	30
WHITTIER	3.80	2.37	3.24	6.58	22	23	19
PASADENA - WALNUT	5.5[a]	2.3[a]	3.9[a]	8.9[a]	32	15	23
TEMPLE CITY	3.02	2.22	2.76	5.33	23	17	18

[a]Values are for 1975 only.

TABLE A6. SOUTH COAST AIR BASIN TOTAL SUSPENDED PARTICULATE

Station	3-Year Averages - 1975 through 1977			Annual Maximums		
	Quarterly Means of 24-Hr Avg.		Annual Mean of 24-Hr Avg.	1975	1976	1977
	FIRST QUARTER	FIRST QUARTER				
ANAHEIM	102.8	119.4	114.9	249	252	283
LA HABRA	118.2	112.9	119.1	220	253	284
LOS ANGELES-DWNTWN	109.3	111.4	117.3	258	206	338
AZUSA	105.8	161.1	135.5	213	226	430
BURBANK	*****	*****	*****	***	***	***
WEST LOS ANGELES	72.7[a]	55.3[a]	70.6[a]	***	***	172
LONG BEACH	*****	*****	*****	***	***	***
LENNOX	109.7	81.2	103.4	227	230	227
WHITTIER	*****	*****	*****	***	***	***
PASADENA - WALNUT	80.6[b]	114.3[b]	108.2[b]	208	202	.369
TEMPLE CITY	96.8[a]	121.9[a]	113.3[a]	***	160	267

[a]Values are for 1977 only.

[b]Values are for 1975 only.

Appendix B

AIR QUALITY SUMMARY FOR SIX CANDIDATE SITES IN THE SAN DIEGO AIR BASIN

TABLE B1. SAN DIEGO AIR BASIN NITROGEN DIOXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
EL CAJON	5.91	4.37	5.34	9.23	32	29	27
CHULA VISTA	4.10	2.66	3.49	6.81	24	23	26
ESCONDIDO	4.62	3.27	4.00	7.33	36	22	21
SAN DIEGO-DOWNTOWN	6.14	3.60	5.11	8.90	46	31	32
OCEANSIDE	2.97	1.78	2.72	6.02	31	33	36
KEARNY MESA	4.05	2.54	3.45	6.96	37	24	30

TABLE B2. SAN DIEGO AIR BASIN NITRIC OXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
EL CAJON	9.92	2.92	6.94	18.11	77	83	80
CHULA VISTA	2.28	1.19	1.80	8.61	53	51	43
ESCONDIDO	6.89	1.80	4.58	13.92	75	84	68
SAN DIEGO-DOWNTOWN	9.46	2.12	6.35	22.43	90	90	89
OCEANSIDE	2.73	1.41	2.20	8.83	61	56	44
KEARNY MESA	2.68	1.25	2.02	9.62	50	48	71

TABLE B3. SAN DIEGO AIR BASIN TOTAL OXIDANT

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Daily Max 1-Hr Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
EL CAJON	4.44	6.13	2.02	5.41	14	16	13
CHULA VISTA	5.29	5.36	2.57	5.64	19	17	21
ESCONDIDO	5.24	7.03	2.45	6.23	33	25	16
SAN DIEGO-DOWNTOWN	4.85	5.27	2.63	5.43	15	17	16
OCEANSIDE	5.91	6.31	3.12	6.56	19	29	25
KEARNY MESA	5.54	6.22	2.72	6.16	23	19	18

TABLE B4. SAN DIEGO AIR BASIN SULFUR DIOXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
EL CAJON	0.45	0.56	0.50	1.20	5	8	3
CHULA VISTA	0.02	0.04	0.03	0.20	7	7	9
ESCONDIDO	0.00[a]	0.03[a]	0.04[a]	0.16[a]	**	0	4
SAN DIEGO-DOWNTOWN	0.55	0.45	0.50	1.20	5	9	5
OCEANSIDE	0.01	0,00	0.01	0.07	3	6	0
KEARNY MESA	0.00	0.00	0.00	0.01	3	1	0

[a]Values are for 1976 and 1977 only.

TABLE B5. SAN DIEGO AIR BASIN CARBON MONOXIDE

Station	3-Year Averages - 1975 through 1977				Annual Maximums		
	Quarterly Means of Avg. Hourly Concentrations		Annual Mean of Average Hourly Conc.	Annual Mean of Daily Max. 1-Hr Conc.	1975	1976	1977
	FIRST QUARTER	THIRD QUARTER					
EL CAJON	2.48	1.33	2.11	4.41	16	15	16
CHULA VISTA	0.93	0.54	0.79	2.13	9	11	9
ESCONDIDO	1.95	0.76	1.45	3.83	18	19	19
SAN DIEGO-DOWNTOWN	2.54	0.87	1.79	4.17	17	17	17
OCEANSIDE	0.89	0.58	0.72	2.03	10	10	8
KEARNY MESA	0.61	0.25	0.49	1.39	8	7	7

TABLE B6. SAN DIEGO AIR BASIN TOTAL SUSPENDED PARTICULATE

Station	3-Year Averages - 1975 through 1977			Annual Maximums		
	Quarterly Means of 24-Hr Avg.		Annual Mean of 24-Hr Avg.	1975	1976	1977
	FIRST QUARTER	FIRST QUARTER				
EL CAJON	91.4	73.1	86.5	199	164	191
CHULA VISTA	63.8	65.7	65.7	122	118	191
ESCONDIDO	91.6	88.2	89.3	176	159	166
SAN DIEGO-ISLAND AVE.	91.6	58.4	76.2	153	170	240
OCEANSIDE	83.8	82.0	85.3	172	146	173
KEARNY MESA-OVERLAND	46.4	52.8	52.1	95	98	100